



Remote Sensing Data Analysis of Ancient Maya Landscapes

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THE ANCIENT MAYA

- The Maya civilization developed in present-day Guatemala, southern Mexico, northern Belize, & western Honduras by 2600 BCE.



- During the Classic Period (250-900 CE), the Maya developed large urban centers leading to many intellectual & scientific achievements.
- A sharp decline occurred around the 9th century CE, the cause of which is debated.
- Evidence shows that deforestation was one of the leading factors that led to this decline.

ABSTRACT

Despite changing landscapes, remote sensing data is able to detect the presence of the ancient Maya. Using IKONOS satellite data from the Petén region of northern Guatemala, the Maya's use of the land was analyzed. The data, which comes in red, green, blue, near-infrared (NIR), and panchromatic bands, was processed in the ENVI software package, utilizing several different techniques to increase contrast and reveal signs of the Maya civilization. With the addition of the NIR band, remote sensing allows a more complete analysis of the landscape. The data typically has 4 meter resolution with the exception of the panchromatic band which has 1 meter resolution. Linear and curvilinear features were of most interest in processing the data due to their rarity in the natural world. These lines most likely represent ancient Maya roads, canals, or modern roads in some cases. Two techniques were used: in one, only features that were able to be observed were documented, while the other technique involved interpolating the existence of a network of roads throughout the landscape.

METHODOLOGY

- Remote sensing data was used to search for evidence of the ancient Maya.
- ENVI software provided the ability to display and analyze any three spectral bands of a similar scene in RGB format.
- Three main configurations were utilized:
 - [421] R: NIR; G: Green; B: Blue
NIR improves vegetation signature
 - [432] R: NIR; G: Red; B: Green
Different technique utilizing NIR
 - [321] R: Red; G: Green; B: Blue
Real color image
- Several analysis techniques were used to increase the visibility of features:
 - Brovey Transform
 - Histogram Stretching
- An overlaying vector map was created to identify linear and curvilinear features.

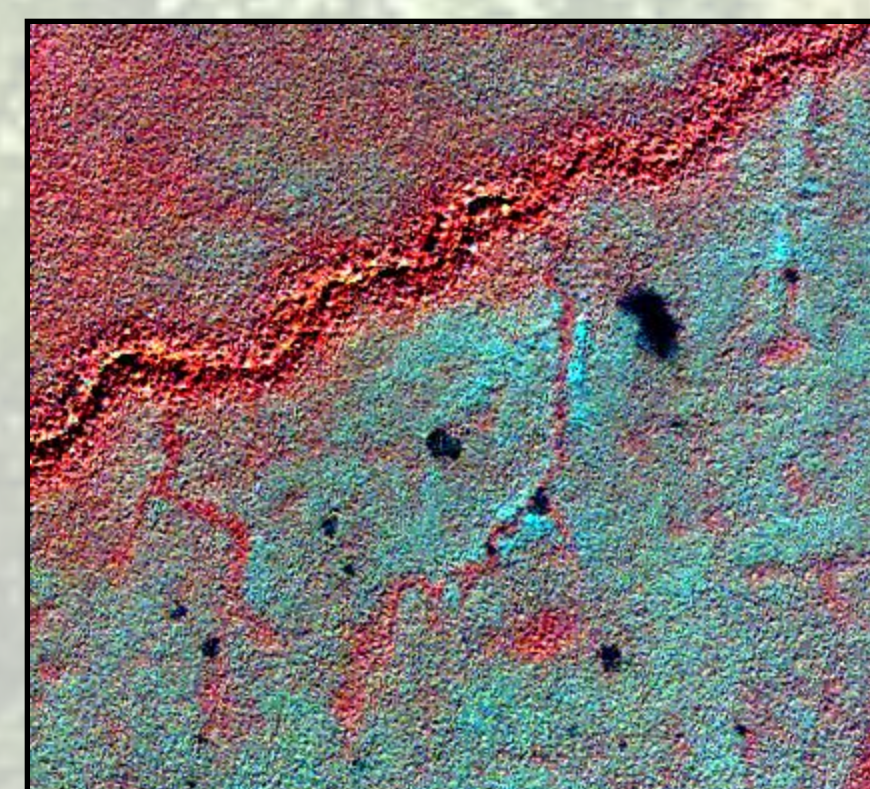
RESULTS

Ancient Maya Canals

True Color [321]

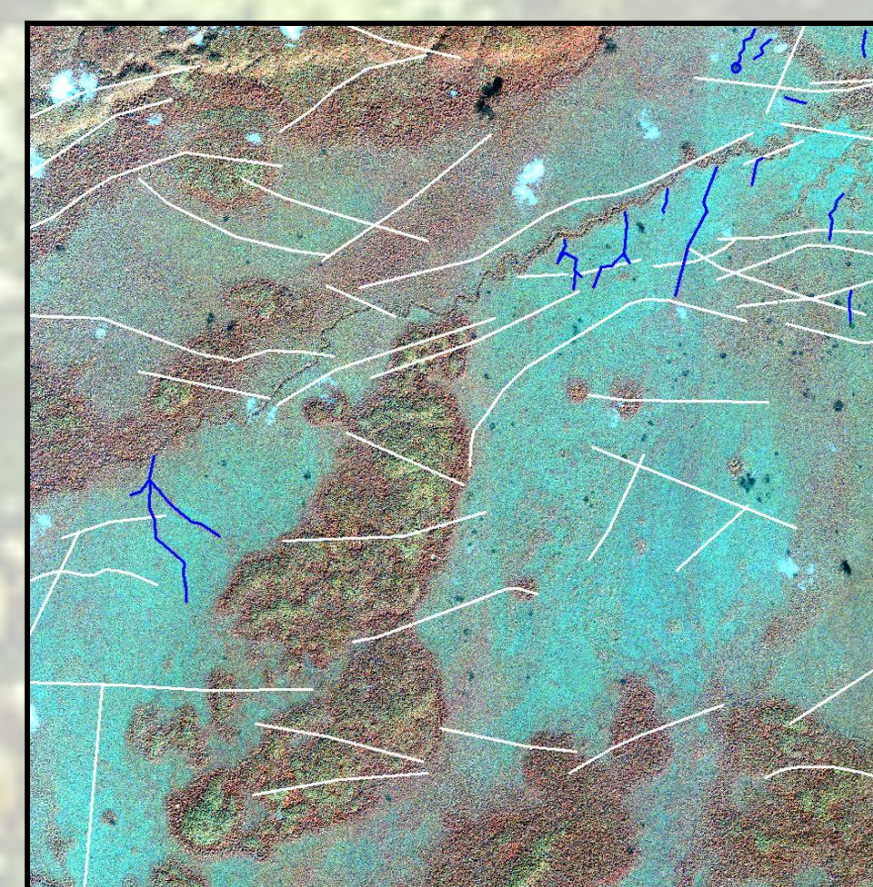
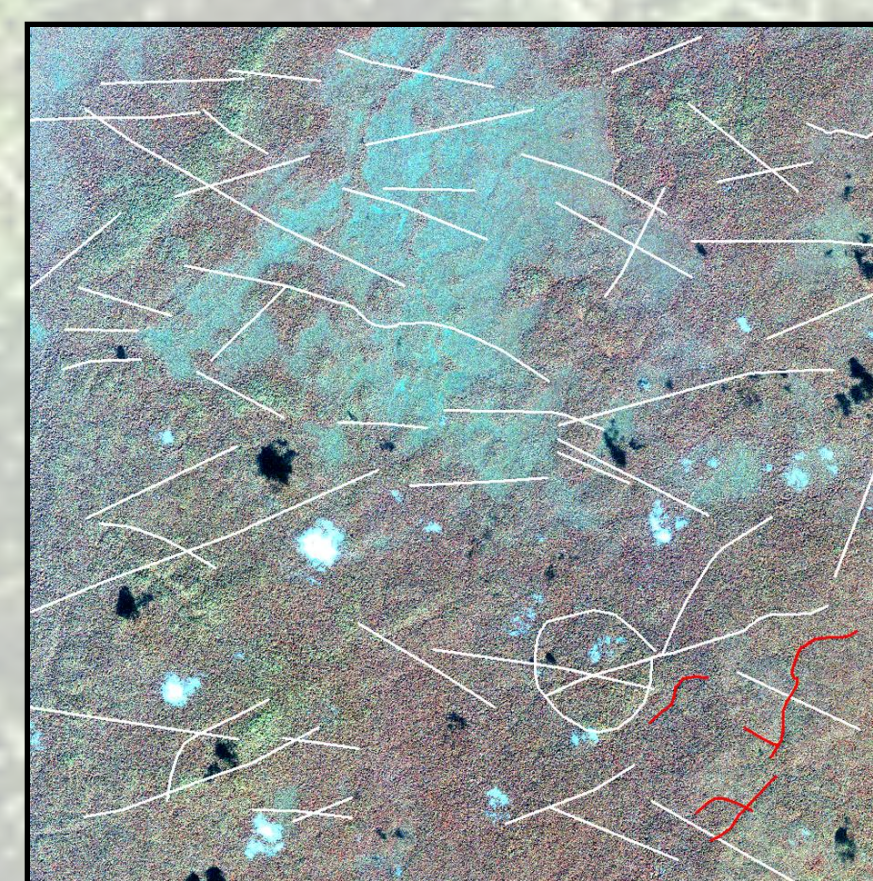


False Color [421]



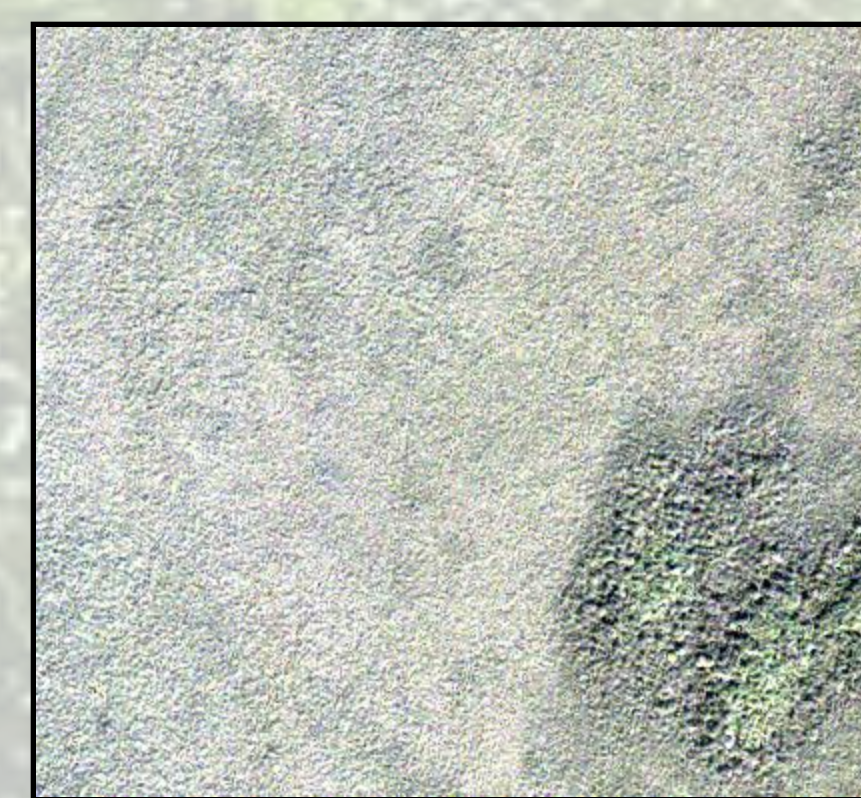
Vector Map Overlay

Full IKONOS Dataset

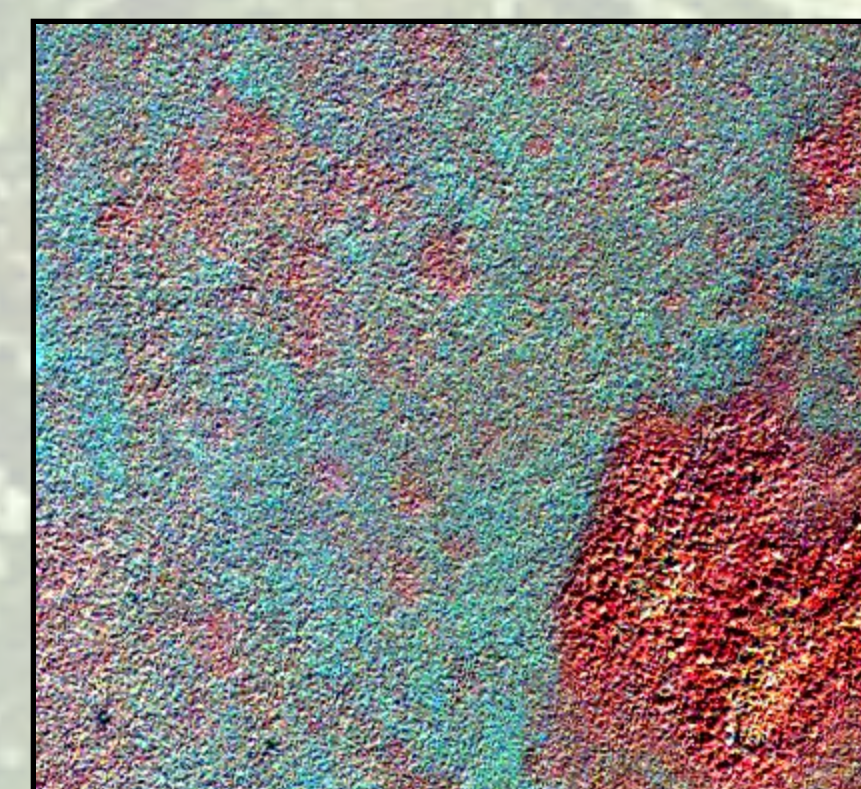


Ancient Maya Roads

True Color [321]



False Color [421]



REMOTE SENSING DATA

- IKONOS satellite data from the northern Guatemala region was used.
- Multispectral data at varying resolutions:
 - 4-meter spectral resolution:*
 - [4] Near-Infrared (NIR): 757 nm – 853 nm
 - [3] Red (R): 632 nm – 698 nm
 - [2] Green (G): 506 nm – 595 nm
 - [1] Blue (B): 445 nm – 516 nm
 - 1-meter spectral resolution:*
 - Panchromatic (PAN): 450 nm – 900 nm
- Swath width: 11 km by 11 km
- Two scenes from 2002 were used in this analysis, representing 242 km² of land studied.
- Landsat data with 30 meter spectral resolution was used as a preliminary dataset.

CONCLUSIONS

- Using the IKONOS data, features are easily identifiable despite the complex landscape.
- Using the NIR band improves identification of features, differentiates between highlands and lowlands, and indicates areas of potential archaeological sites.
- Although this data gives locations of Maya settlement, ground-truthing will ultimately determine the accuracy of these finds.
- This data enables cheaper and more precise ground operations when compared to traditional techniques.
- Future use of this technology:
 - Narrow-band imaging (690 nm – 700 nm) to determine plant stress